Factors Associated with Clinician Adherence to USPSTF Diabetes Screening Recommendations

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Abstract

Introduction/Objectives: Diabetes and prediabetes impact nearly half of the US adult population and are associated with significant health risks but may be underdiagnosed. Effective screening may improve diagnosis and give patients opportunity to manage their disease. The purpose of this study was to determine screening rates, identify characteristics predictive of screening, and evaluate correct diagnosis of diabetes and prediabetes.

Methods: Retrospective chart review of 71 433 patients eligible for diabetes screening, defined by completing A1c test within the 3-year study period.

Results: A total of 31.3% of eligible patients received diabetes screening. Factors associated with screening include older age, female sex, non-white race, Hispanic ethnicity, Medicare or Medicaid insurance, higher BMI, and having a medical comorbidity. History of prediabetes or gestational diabetes were the strongest predictors for diabetes screening, but history of gestational diabetes was under-documented. Of those screened, 10.4% had a result consistent with diabetes and 51.8% had a result consistent with prediabetes. However, 52.9% of these patients had a missed diagnosis.

Conclusions: Findings of this study indicate the need for uniform coverage for diabetes screening for all insurances, increased documentation of gestational diabetes to improve screening for patients with this history, and improving accurate diagnosis after screening is completed.

Keywords

primary care, diabetes, prediabetes, gestational diabetes, screening

Introduction

Across the United States, 34.1 million adults (13% of the adult population) have diabetes.[1] However, 21.4% of US adults with diabetes are undiagnosed.[1] Diabetes increases risk for numerous serious health issues, including: vascular disease, renal disease, blindness, neuropathy and amputation.[1,2] Patients with undiagnosed diabetes are at higher risk for stroke, coronary heart disease, and peripheral vascular disease.[2] Additionally, 88 million adults (34.5% of the US adult population) have prediabetes, which is associated with an increased risk of progression to diabetes.[1] Undiagnosed patients may be missing opportunities to make lifestyle changes or take medications that may decrease the risk of progression to diabetes.

Effective screening allows patients with prediabetes or diabetes to be diagnosed sooner, and timely treatment may result in decreased risk of associated complications.[2] Although multiple criteria exist, the United States Preventive Services Taskforce (USPSTF) limited criteria recommends screening adults aged 40 to 70 years who are overweight or obese ([body mass index] BMI $\geq$ 25 kg/m^2) every 3 years, and the expanded criteria recommend earlier screening for members of high risk racial/ethnic groups and people with a history of gestational diabetes or polycystic ovarian syndrome or a family history of diabetes.[3]

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One study showed that 76% of US adults met screening criteria; however, only 46.2% of those who met criteria were actually screened.[4] Of those eligible for screening, 3.7% had undiagnosed diabetes and 46.2% had undiagnosed prediabetes.[4] Studies have consistently found higher rates of screening in patients with female sex, older age, higher body mass index, non-white race, comorbidities such as hypertension or dyslipidemia, and regular medical health care.[4-6] One study on the impact of insurance showed that insured patients were more likely to receive screening.[5] Another study found that patients with private insurance were more likely to receive screening compared to patients with public insurance who were less likely to receive screening.[6]

The objectives of this study were to examine predictors of diabetes screening in a Practice and Community-Based Research Network (PCBRN). We further evaluated the number of patients who were screened for diabetes who received the correct diagnosis of prediabetes or diabetes.

Methods

To meet the study objectives, we conducted a retrospective chart review of patients of the PCBRN, which was composed of 50 urban, suburban, and rural primary care practices (33 Family Medicine, 14 Internal Medicine, and 3 Family and Internal Medicine practices), including 4 practices with resident physicians. Practices ranged in size from 1 to 58 clinicians with an average practice size of approximately 6 clinicians. There were 149 Family Medicine clinicians, including 14 residents, and 147 Internal Medicine clinicians, including 37 residents. Patients of these practices were included if they had at least one visit with their Primary Care Practitioner (PCP) in the past 3 years and met USPSTF limited screening criteria (40-70 years of age and BMI $\geq 25\,kg/m^2$).[3] Screening based on this criteria has been found to have a sensitivity of 47.3% and a specificity of 71.4%.[7] This study excluded those with previously diagnosed diabetes or who were pregnant during the study period. Participants with a history of prediabetes were included if they met criteria for diabetes screening. We did not exclude patients with conditions associated with increased erythrocyte turnover conditions that would make A1c testing less accurate, such as malaria, blood loss, hemolysis, or chronic anemia.[8]

All data were extracted from the electronic medical record (EMR). The primary outcome was diabetes screening, measured by completion of a validated point-of-care or laboratory A1c test during the three-year study period (9/1/2016 to 8/31/2019). Fasting glucose was not used as the electronic health record did not specify if glucose test results were fasting or non-fasting. Predictor variables included demographics (age at study onset, sex, race, ethnicity, insurance type at study end), BMI at first visit during study period, PCP specialty (Family or Internal Medicine), and comorbidities at study end including: hypertension (I10), hyperlipidemia (E78.0–2, E78.4–5), prediabetes (including "impaired fasting glucose" or "impaired glucose tolerance") (R73.01–03), polycystic ovarian syndrome (E28.2), and gestational diabetes (O24.4, Z86.32), and if obesity was listed on the patient's problem list (E66–E66.9, Z68.3–45). These comorbidities were chosen due to their known risk association with type 2 diabetes.[9,10] We also determined if patients' A1c was consistent with prediabetes (A1c 5.7-7.4%) or diabetes (A1c $\geq 6.5\%$) and if patients had a diagnosis of prediabetes or diabetes added to their problem list during the three-year study period.

Data were analyzed to meet the study objectives using IMB SPSS, version 26. We first determined the percentage of eligible patients who completed diabetes screening. We then evaluated if any of the predictor variables were associated with the primary outcome of diabetes screening using logistic regression. We then determined what diagnoses were supported by A1c testing results and evaluated the number of patients who received the correct diagnosis. This study was approved by the Lehigh Valley Health Network Institutional Review Board.

Results

Most participants were white, non-Hispanic, and had commercial insurance. Slightly over half of participants were female and over half had a Family Medicine PCP. While many patients had a diagnosis of hypertension (43%) or hyperlipidemia (41%), very few patients had a diagnosis of polycystic ovarian syndrome (0.2%) or a documented history of gestational diabetes (0.2%). Of the 71,433 patients who were eligible for screening, 22,379 (31.3%) completed diabetes screening with an A1c test (Table 1).

Demographic characteristic associated with higher odds of diabetes screening included older age, female sex, non-white race, Hispanic ethnicity, seeing an Internal Medicine PCP, and having Medicaid or Medicare insurance. All comorbidities assessed were associated with higher odds of diabetes screening, with prediabetes (OR 8.78, 95% CI 8.28-9.31) and a history of gestational diabetes (OR 6.01, 95% CI 4.14-8.72) most strongly associated (Table 1). In addition, those who received screening had a significantly higher BMI than those who were not screened (mean difference 2.3 kg/m2, 95% CI 2.2-2.4).

Of the overall sample, 8299 (11.6%) received a diagnosis of prediabetes. However, 11 583 (51.8%) of those who had an A1c test had a result consistent with prediabetes. 55.9% of those patients meeting laboratory criteria for prediabetes did not receive a diabetes-related diagnosis. Of those who had an A1c result consistent with diabetes, 37.9% did not receive a diagnosis of diabetes, including 27.4% who did not receive any diabetes-related diagnosis (Table 2).

Table 1. Demographics and Odds of Having A1c Screening for Diabetes for 71,433 Primary Care Patients Eligible for Diabetes Screening (40-70 years Old, Body Mass Index (BMI) $\geq$25 kg/m^2, No Diagnosis of Diabetes On Start of Study, Not Pregnant During the Study).

	Overall N=71 433	A1c done N=22 379 (31.3%)	A1c not done N=49 054 (68.7%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age, years*†	55.8 (8.0)	57.0 (7.8)	55.3 (7.9)	1.03 (1.03-1.03)	1.01 (1.01-1.02)
Female sex‡§	38 843 (54.4%)	11 624 (51.9%)	27 219 (55.5%)	0.87 (0.84-0.9)	0.85 (0.82-0.88)
Non-white race‡‖	9053 (12.7%)	3145 (14.5%)	5908 (12.5%)	1.19 (1.13-1.24)	1.15 (1.09-1.23)
Hispanic ethnicity‡¶	7327 (10.3%)	2709 (12.3%)	4618 (9.7%)	1.32 (1.25-1.39)	1.31 (1.22-1.4)
Internal Medicine PCP‡#	31 143 (43.6%)	9797 (43.8%)	21 346 (43.5%)	1.01 (0.98-1.04)	1.04 (1.0-1.08)
Insurance‡					
Commercial	46 662 (65.3%)	13 409 (60.3%)	33 253 (68.3%)	Ref	Ref
Medicaid	6710 (9.4%)	2287 (10.3%)	4423 (9.1%)	1.28 (1.21-1.35)	1.25 (1.17-1.34)
Medicare	15 214 (21.3%)	5848 (26.3%)	9366 (19.2%)	1.55 (1.49-1.61)	1.15 (1.09-1.21)
Self-pay	2375 (3.3%)	711 (3.2%)	1664 (3.4%)	1.06 (0.97-1.16)	1.05 (0.94-1.16)
Comorbidities‡					
Hypertension	30 945 (43.3%)	12 394 (55.4%)	18 551 (37.8%)	2.04 (1.98-2.11)	1.38 (1.33-1.43)
Hyperlipidemia	29 299 (41%)	11 982 (53.5%)	17 317 (35.3%)	2.11 (2.05-2.18)	1.61 (1.55-1.67)
Prediabetes	8299 (11.6%)	6507 (29.1%)	1792 (3.7%)	10.8 (10.2-11.4)	8.78 (8.27-9.3)
Polycystic ovarian syndrome	140 (0.2%)	78 (0.3%)	62 (0.1%)	2.76 (1.98-3.86)	2.81 (1.92-4.12)
History gestational diabetes	152 (0.2%)	100 (0.4%)	52 (0.1%)	4.23 (3.02-5.92)	5.95 (4.09-8.64)
BMI $\geq$30 kg/m^2	39 451 (55.2%)	14 810 (66.8%)	24 641 (51.3%)	1.91 (1.85-1.97)	1.13 (1.08-1.19)
Obesity on problem list	15 921 (22.3%)	7327 (32.7%)	8594 (17.5%)	2.29 (2.21-2.38)	1.43 (1.36-1.5)
BMI (kg/m^2)*†	32.1 (6.1)	33.7 (6.7)	31.4 (5.6)	1.06 (1.06-1.06)	1.04 (1.03-1.04)

*Variable reported as mean (SD).
†Change in odds of diagnosis with each unit increase in continuous variable.
‡Variable reported as n (%).
§Reference to male sex.
‖Reference to white race.
¶Reference to non-Hispanic ethnicity.
#Reference to Family Medicine PCP.

Table 2. Diagnoses Made for 71 433 Primary Care Patients Eligible for Diabetes Screening by A1c Screening Results.

	No diabetes-related diagnosis made (N=61 312)	Prediabetes diagnosis made (N=8299)	Diagnosis of Diabetes made (N=1990)*
No A1c done (N=49 054)†	47 189	1792	83
A1c does not support diabetes-related diagnosis (N=8461)‡ • All A1c <5.7%	7005	1439	21
A1c supports Prediabetes diagnosis (N=11 583)§ • A1c 5.7 to 6.4%	6479	4750	435
A1c supports diagnosis of diabetes (N=2335)‖ • A1c $\geq$6.5%	639	318	1451

*168 people total were diagnosed with both diabetes and prediabetes.
†10 people who did not have an A1c done were diagnosed with both diabetes and prediabetes.
‡4 people with A1c <5.7% were diagnosed with both diabetes and prediabetes.
§81 people with A1c 5.7 to 6.4% were diagnosed with both diabetes and prediabetes.
‖73 people with A1c $\geq$6.5% were diagnosed with both diabetes and prediabetes.

Discussion and Conclusions

Overall 31.3% of participants completed diabetes screening within the 3 year study period. This rate is lower than rates seen in other studies which used fasting glucose as well as A1c and may be due to our restricted use of A1c only.[4,5] Consistent with prior studies, we did find an increased likelihood of screening in female patients, older patients, and patients with risk factors, including: non-white race, comorbidities, and higher BMI.[4]

In prior studies, health insurance, specifically private insurance coverage,[5,6] was associated with diabetes screening, but this was not seen in our study as the rate of screening was not significantly different for patients without insurance. Interestingly, we did find an increased rate of screening for patients with Medicare or Medicaid. This may be due to variations in coverage between insurance types or a concern about copays. According to the Centers for Medicaid and Medicare, screening for diabetes is covered for those with hypertension, dyslipidemia, obesity, a history of high blood sugar, or 2 or more other risk factors, including: age >65, overweight, family history of diabetes, or a history of gestational diabetes.[9] Medicaid coverage for screening varies by state, but in most states screening for diabetes is covered with no or a very small copay.[11] Commercial insurance may have much wider variation in coverage and copay causing confusion for patients and clinicians. In addition, patients with high deductible insurance may pay the full cost of tests that are not classified as "preventive." We were only able to evaluate completed lab results and were not able to determine when labs were ordered but not completed by the patient.

We did note a significantly higher screening rate for patients with a history of gestational diabetes at 65.8%. This is consistent with other studies which found the rates for screening for women with a history of gestational diabetes was 67%.[12] However, 6%-9% of pregnant women develop gestational diabetes,[13] while only 0.2% of our sample had a documented history of gestational diabetes. This suggests the need to improve documentation of history of gestational diabetes to prevent clinicians missing this important risk factor and improve care for patients who need regular diabetes screening.

In this study 62.2% of the population screened had labs consistent with diabetes or prediabetes. This is consistent with the study by O'Brien, et al, which found a positive predictive value for the USPSTF limited criteria of 62% (95% CI 57.8-66.1).[7] This suggests that the high rate of diabetes and prediabetes is not due to clinicians selecting high risk patients for screening, but rather is the true prevalence in the population and clinicians are potentially missing diagnoses for patients who were eligible but not screened. In addition, clinicians missed the diagnoses for 7363 patients, 32.9% of those who were screened. Clinicians may benefit from EMR interventions including real-time reminders to screen patients who meet eligibility criteria and interpretation of results.

Strengths of this study were the large sample size and the inclusion of urban, suburban, and rural practices. The major limitations of this study were the retrospective chart review study design, which does not allow for the determination of causation in patient factors associated with screening, and use of EMR for data. The data extracted from the EMR limited the study to the use of completed A1c as we were unable to determine if glucoses were fasting or non-fasting or if labs had been ordered but not completed.

Opportunities for future research include evaluation of ordered but uncompleted labs to identify gaps in screening, as well as qualitative evaluation to understand the drivers for clinician recommendations and orders to screen for diabetes and patient completion of screening tests. This may lead to interventions to improve screening, such as EMR cues to prompt testing, assistance with accurate interpretation of A1c test results, and improved documentation of gestational diabetes history.

This study found a low rate of diabetes screening, but a high rate of diabetes and prediabetes in the population screened. Novel findings of this study include a higher rate of screening in populations receiving Medicare and Medicaid insurance. Patients may benefit from improved screening if both all insurance providers aligned their criteria for screening with USPSTF and American Diabetes Association (ADA) recommendations. We also found a strong association between a history of gestational diabetes and diabetes screening but significant under-documentation of this history resulting in potential missed opportunities.

Declaration of Conflicting Interests

Funding

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